General

Guideline Title

ACR Appropriateness Criteria® acute respiratory illness in immunocompromised patients.

Bibliographic Source(s)

Heitkamp DE, Albin MM, Chung JH, Crabtree TP, Iannettoni MD, Johnson GB, Jokerst C, McComb BL, Saleh AG, Shah RD, Steiner RM, Mohammed TL, Ravenel JG, Expert Panel on Thoracic Imaging. ACR Appropriateness CriteriaÂ® acute respiratory illness in immunocompromised patients [online publication]. Reston (VA): American College of Radiology (ACR); 2014. 8 p. [53 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Heitkamp DE, Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Dyer DS, Ginsburg ME, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® acute respiratory illness in immunocompromised patients. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 6 p. [45 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Acute Respiratory Illness in Immunocompromised Patients

Variant 1: Cough, dyspnea, chest pain, fever.

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	9		
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 2: Negative, equivocal, or nonspecific chest radiograph.

Radiologic Procedure	Rating	Comments	RRL*
CT chest without contrast	9		
CT chest with contrast	3	Consider this procedure if hemoptysis is present.	
CT chest without and with contrast	1		
Ga-67 scan lung	1	Consider this procedure if PJP is suspected.	
Tc-99m DTPA scan lung	1	Consider this procedure if PJP is suspected.	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Positive chest radiograph, multiple, diffuse or confluent opacities.

Radiologic Procedure	Rating	Comments	RRL*
CT chest without contrast	7		
Transthoracic needle biopsy	5	Consider this procedure if a serious opportunistic infection is suspected.	Varies
CT chest with contrast	3	Consider this procedure if hemoptysis is present.	
CT chest without and with contrast	1		
Ga-67 scan lung	1	Consider this procedure if PJP is suspected.	
Tc-99m DTPA scan lung	1	Consider this procedure if PJP is suspected.	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative

Radiologic Procedure	Rating	Comments	RRL* Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Positive chest radiograph, noninfectious disease suspected.

Radiologic Procedure	Rating	Comments	RRL*
CT chest without contrast	8		
CT chest with contrast	5	Consider this procedure if neoplasm or pulmonary embolus is suspected. Consider this procedure if hemoptysis is present.	
Transthoracic needle biopsy	5	Consider this procedure if thoracic malignancy suspected.	Varies
CT chest without and with contrast	1		
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

There are many causes of immunodeficiency likely to be encountered by today's physician. With advances in medical techniques such as solid organ and stem cell transplantation, cancer therapy, and immunosuppressive therapy, along with the continued presence of the human immunodeficiency virus (HIV), the number of immunocompromised patients in our health care system has greatly increased in recent decades. Other causes of immunosuppression seen in medicine today include hematologic malignancies, congenital immunodeficiency syndromes, and the mildly impaired host states, such as diabetes mellitus, advanced age, malnutrition, alcoholism, chronic debilitating illness, and chronic obstructive lung disease. Determining the most likely pathogen causing pneumonia in these patients can be difficult given the diverse causes of immunosuppression. Based on the patient's underlying disease or related therapy, it helps to determine what major component of the immune system has been damaged (i.e., T-cell, B-cell, phagocytosis, complement system, or splenic function). Knowledge of what immune defect has occurred, as well as the time course from its occurrence to the onset of patient symptoms, often aids in establishing a definitive diagnosis or more specific differential diagnosis.

Acute respiratory illness (ARI) constitutes a group of signs and symptoms that develop over a brief interval (hours to weeks), some of which are constitutional (e.g., fever, chills, and weight loss) and some of which are organ specific (e.g., cough, shortness of breath, and chest pain). In immunocompromised individuals, the respiratory system is one of the most frequently involved organ systems that results in complications, often initially manifesting with symptoms of ARI. Of all pulmonary complications in patients with immunodeficiency, pulmonary infections comprise nearly 75%, many of which progress along a rapid and potentially fatal course. Noninfectious causes of ARI in the immunocompromised population should also be considered, however, and include such entities as pulmonary edema, drug-induced lung disease, atelectasis, malignancy (including post-transplant lymphoproliferative disorder), radiation-induced lung disease, alveolar hemorrhage, diffuse alveolar damage, organizing pneumonia, rejection of lung transplantation, and thromboembolic disease.

Overview of Imaging Modalities

Despite modern advances in computed tomography (CT) technology, the chest radiograph remains the first-line in the diagnostic evaluation of

immunocompromised patients presenting with ARI. The morphology and distribution of abnormalities on the chest radiograph, along with changes on serial radiographic examinations, can aid in arriving at a differential diagnosis. Chest radiographs also demonstrate the presence of complicating features of pneumonia, such as empyema or abscess. The well-known shortcomings of the chest radiograph, however, are its lack of specificity with regard to actual pathogens, and its overall low sensitivity for detectable abnormalities in immunosuppressed patients with symptomatic disease.

CT is more sensitive and specific than chest radiography for detecting subtle pulmonary findings. Although not recommended for the initial imaging evaluation of patients with ARI, the use of CT has been described in several scenarios regarding the immunocompromised host: to evaluate patients who are clinically symptomatic for ARI, but who have equivocal or normal chest radiographic findings; to better characterize abnormal but nonspecific chest radiograph findings; and to provide essential information for determining the appropriate method and site of lung biopsy. Because the appearance and distribution of airspace abnormalities are better characterized with the improved resolution provided by CT, certain diseases such as *Pneumocystis jirovecii* pneumonia (PJP, previously known as *Pneumocystis carinii* pneumonia), invasive pulmonary aspergillosis and *Cytomegalovirus* (CMV) can be identified on CT with a higher degree of confidence than they can on radiography. Recognizing the CT patterns associated with these infections allows for the critical initiation of early empiric therapy, often based on a presumptive radiologic diagnosis, all the while waiting for more definitive microbiologic data which may not be available for days or weeks.

Although chest radiography and chest CT are the mainstay imaging modalities in evaluating the immunocompromised host with ARI, nuclear scintigraphy using gallium-67 (Ga-67) or technetium-99 metastable (Tc-99m) diethylenetriamine pentaacetate (DTPA) radiotracers have quite specific but rarely used indications in this setting. Ga-67 can be used to help diagnose *Mycobacterium avium intracellulare*, *Mycobacterium tuberculosis*, and lymphoma based on increased radiotracer activity in hilar and mediastinal lymph nodes. However, this finding is nonspecific, and distinguishing between a malignant and infectious or inflammatory etiology may require a tissue diagnosis. Additionally, Ga-67 can be used to evaluate for the presence of PJP within the lungs in cases where conventional imaging has turned up normal or equivocal findings. Some studies have shown gallium scintigraphy to be more sensitive and specific for the presence of PJP than both chest radiograph and chest CT in acquired immune deficiency syndrome (AIDS) patients.

Discussion of Imaging Modalities by Variant

Variant 1: Cough, Dyspnea, Chest Pain, Fever

When immunocompromised patients present with symptoms of acute onset fever, cough, and shortness of breath, chest radiography should be the first radiologic examination performed. The chest radiograph typically identifies abnormalities if present, although it can be normal in up to 10% of symptomatic patients with proven disease and up to 39% of AIDS patients with PJP. Although the chest radiograph has been shown to be of little value in predicting the causative organisms of pulmonary infections, it remains useful in determining the extent of pulmonary disease and in screening for associated complications. For patients with acute onset cough and fever or a single focal, segmental, or lobar airspace opacity on chest radiograph, bacterial pneumonia is the most likely etiology of pulmonary infection.

Fungal pneumonias, PJP, tuberculosis (TB), and noninfectious causes of ARI such as atelectasis and edema are also in the differential diagnosis, although their clinical presentations often differ. If the initial chest radiograph is suggestive of edema, serial chest radiography with concomitant diuresis, for example, would be helpful in confirming cardiogenic pulmonary edema and differentiating it from infectious causes of ARI. There are many clinical scenarios in the immunocompromised patient, such as isolated segmental pneumonia or presumed pulmonary edema, where further radiologic imaging with CT may not be needed unless the patient's clinical picture worsens or fails to improve with therapy.

Variant 2: Negative, Equivocal, or Nonspecific Chest Radiograph

One important limitation of the chest radiograph is its low overall sensitivity in detecting pulmonary infection, a problem compounded in immunocompromised patient whose weakened immune systems often struggles to mount an adequate inflammatory response. Indeed, the chest radiograph in an immunosuppressed patient with cough, dyspnea, chest pain, and fever may be equivocal or even negative despite a high suspicion for pulmonary disease. In this setting, chest CT has been shown to offer a distinct advantage in sensitivity for detecting subtle parenchymal abnormalities. In one study, CT performed in febrile neutropenic patients with normal chest radiographs showed pneumonia in 60% of cases at least 5 days before the abnormalities became visible on chest radiographs. The advantage likely lies in the ability of cross-sectional imaging to provide 3-dimensional (3-D) volumetric data, as opposed to the low-resolution 2-D data provided by plain radiography. With the improved resolution of CT, even subtle parenchymal abnormalities that would escape detection on the chest radiograph become manifest. The appearance and distribution of lung abnormalities on CT, coupled with information of the patient's clinical presentation, are often quite helpful in formulating a differential diagnosis.

In patients whose primary immune defect is HIV infection, a normal or only near-normal chest radiograph can occasionally occur when they are infected with TB, nontuberculous mycobacteria, or PJP. In the setting of an HIV infection, if there is a high clinical suspicion of a pulmonary infection along with a normal or near-normal chest radiograph, a CT may be warranted to assess for subtle pulmonary parenchymal disease. Findings of parenchymal and nodal TB in the thorax can be readily evident on CT in the setting of a normal or near-normal chest radiograph. In

one series, 7.2% of patients with HIV and pulmonary TB had normal chest radiographs. Among patients with culture-positive TB and normal chest radiographs in this series, 90% had negative smears for acid-fast bacilli. In patients with nontuberculous mycobacterial infections, relatively subtle findings of small airways disease including mild bronchiectasis, peribronchial thickening, foci of mucoid impaction, and air trapping may be evident only on CT. Another review found that PJP findings on chest radiography are often nonspecific and that up to one-third of patients infected with PJP may actually have normal chest radiographs. Patients with PJP and normal chest radiographs often have only subtle findings on CT, such as patchy ground-glass opacities and small nodules or cysts.

Although one study found CT to be more sensitive and specific than nuclear medicine studies for diagnosing PJP, as well as being cheaper and faster to perform, there is some literature supporting the utility of performing Tc-99m DTPA and Ga-67 lung scans when PJP is suspected. A classic study involving AIDS patients showed that Ga-67 lung scans have an overall sensitivity of 94% and specificity of 74% for PJP. When the chest radiograph is negative or equivocal at the time of admission, however, the sensitivity of Ga-67 drops to 86%, though the specificity improves to 85%. Another study noninvasively detected PJP in 34 of 36 patients using Tc-99m DTPA lung scanning, thereby reducing the need for bronchoscopy to confirm the diagnosis. Despite the medical literature supporting the use of nuclear medicine to establish the diagnosis of PJP, CT is the modality which most efficiently and reliably depicts the findings of the disease, such as bilateral ground-glass opacities with a perihilar predominance, smooth interlobular septal thickening, and bilateral lung cysts often with a subpleural, upper lobe distribution.

Variant 3: Positive Chest Radiograph, Multiple, Diffuse or Confluent Opacities

Chest CT also is indicated in the immunocompromised patient when the radiograph is positive and shows multiple, confluent or diffuse airspace opacities. In these situations, although the chest radiograph may serve as an effective screening or triaging modality, its inherent low resolution makes it a suboptimal examination to determine the detailed morphology of the opacities, as well as the pattern and distribution of disease, thereby making it an unsuitable standalone study. For example, in febrile patients having undergone stem cell transplantation, the ability of CT to detect halos of ground glass-opacity around scattered pulmonary nodules is essential in making the early presumptive diagnosis of invasive aspergillosis, allowing initiation of empiric antifungal therapy and improved prognosis.

Common patterns of disease found on chest CT in patients with ARI include pulmonary nodules, tree-in-bud nodules, parenchymal consolidation, and ground-glass opacities. These patterns are described in the literature to define the CT appearances of many pulmonary infections in the immunocompromised host, including PJP, invasive pulmonary aspergillosis, mucormycosis, candidiasis, CMV pneumonia, human metapneumovirus, and mycobacterial pneumonias. Some researchers even advocate the use of high-resolution chest CT so that lung parenchymal abnormalities can be best characterized in terms of morphology and patterns of disease, allowing better prediction of the underlying etiologic agents in this vulnerable population.

Knowledge of common pulmonary pathogens, their characteristic appearances on chest CT, their associations with specific immunosuppressive states (e.g., solid organ transplantation, stem cell transplantation, chronic steroid use, etc.), and their usual time course to infect relative to therapy are all important elements when considering a differential diagnosis. The well-recognized patterns of disease that CT is able to detect, taken together with the appropriate clinical and laboratory data, go a long way in piecing together the diagnostic puzzle.

In some clinical scenarios of patients with ARI, transthoracic or transbronchial biopsy may be an appropriate action to allow for the identification of the specific organism causing the airspace opacities. Early identification of the underlying pathogen allows for prompt and appropriate treatment of the pneumonia in these vulnerable patients. When a biopsy is being considered, CT allows for optimal characterization of the potential target lesions and determination of the safest route and equipment to be used.

Variant 4: Positive Chest Radiograph, Noninfectious Disease Suspected

Noninfectious pulmonary disease may be suspected in the immunocompromised patient with ARI. For example, these patients sometimes receive cytotoxic medications over the course of their treatment that can produce respiratory symptoms. Additionally, cancer and cancer therapy are both recognized risk factors for venous thromboembolism, a well-established and dreaded complication affecting the circulatory system, which can lead to symptoms of shortness of breath and chest pain. The improved resolution provided by chest CT provides a much more definitive assessment of any nonspecific opacities found on chest radiography that are suspected to be noninfectious based on the patient's clinical presentation. Noninfectious complications that can contribute to ARI in immunocompromised hosts can include pulmonary edema, drug-induced lung disease, atelectasis, malignancy, radiation-induced lung disease, alveolar hemorrhage, diffuse alveolar damage, organizing pneumonia, rejection of lung transplantation, graft-versus-host disease, and thromboembolic disease.

The cross-sectional imaging provided by CT allows for optimal characterization of abnormalities discovered on chest radiography. In patients with prior lung malignancy, recurrence of the primary cancer or development of a secondary lung tumor should always remain a suspicion when the chest radiograph is abnormal. In a similar fashion, metastatic disease to the lungs can occur from nonthoracic primary sites.

Studies have shown CT to be more sensitive than radiography in detecting drug-induced lung injury from such agents as bleomycin, busulfan,

carmustine, and cyclophosphamide. Chest CT has been shown for years now to be the most efficient and effective means to evaluate for suspected acute pulmonary embolism.

Summary of Recommendations

- Chest radiography is indicated early in the evaluation of the immunocompromised patients with ARI. If the radiograph demonstrates a single, focal airspace abnormality and the patient presents with symptoms of an acute bacterial pneumonia, further imaging with CT may not be needed.
- If the radiograph is normal, equivocal, or nonspecific, but clinical suspicion for disease is high, CT can be performed to evaluate for subtle pulmonary abnormalities or to better characterize nonspecific radiographic disease.
- The ability to recognize patterns of airspace disease on chest CT plays an essential role in refining a differential diagnosis — a particular advantage over the nonspecific chest radiograph.
- CT is also indicated for the planning of image-guided (or transbronchial) biopsy and/or therapy of intrathoracic abnormalities noted on chest radiographs.
- Nuclear scintigraphy has a very specific but rarely role in the evaluation of immunocompromised patients with ARI.

Abbreviations

- CT, computed tomography
- DTPA, diethylenetriamine pentaacetate
- Ga-67, gallium-67
- PJP, *Pneumocystis jirovecii* (*carinii*) pneumonia
- Tc-99m, technetium-99 metastable

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
	<0.1 mSv	<0.03 mSv
	0.1-1 mSv	0.03-0.3 mSv
	1-10 mSv	0.3-3 mSv
	10-30 mSv	3-10 mSv
	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

- Immunodeficiency (including human immunodeficiency virus [HIV], hematologic malignancies, congenital immunodeficiency syndromes, and the mildly impaired host states, such as diabetes mellitus, advanced age, malnutrition, alcoholism, chronic debilitating illness, and chronic obstructive lung disease)
- Acute respiratory illness (including pulmonary infections, pulmonary edema, drug-induced lung disease, atelectasis, malignancy [including

post-transplant lymphoproliferative disorder], radiation-induced lung disease, alveolar hemorrhage, diffuse alveolar damage, organizing pneumonia, rejection of lung transplantation, and thromboembolic disease)

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Allergy and Immunology

Family Practice

Infectious Diseases

Internal Medicine

Nuclear Medicine

Pulmonary Medicine

Radiology

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of various imaging modalities in the initial evaluation of acute respiratory illness in immunocompromised patients

Target Population

Immunocompromised patients with acute respiratory illness

Interventions and Practices Considered

1. X-ray, chest
2. Computer tomography (CT), chest
    - Without contrast
    - With contrast
    - Without and with contrast
3. Gallium-67 (Ga-67) scan, lung
4. Technetium-99 metastable diethylenetriamine pentaacetate (Tc-99m DTPA) scan, lung
5. Transthoracic needle biopsy

Major Outcomes Considered

- Utility of radiologic examination procedures in differential diagnosis
- Sensitivity and specificity of radiologic procedures

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Summary

Of the 46 citations in the original bibliography, 24 were retained in the final document. Articles were removed from the original bibliography if they were more than 10 years old and did not contribute to the evidence or they were no longer cited in the revised narrative text.

A new literature search was conducted in August 2013 to identify additional evidence published since the *ACR Appropriateness Criteria® Acute Respiratory Illness in Immunocompromised Patients* topic was finalized. Using the search strategy described in the literature search companion (see the "Availability of Companion Documents" field), 30 articles were found. Fifteen articles were added to the bibliography.

Fifteen articles were not used due to either poor study design, the articles were not relevant or generalizable to the topic, the results were unclear, misinterpreted, or biased, or the articles were already cited in the original bibliography.

The author added 14 citations from bibliographies, Web sites, or books that were not found in the new literature search.

See also the American College of Radiology (ACR) Appropriateness Criteria® literature search process document (see the "Availability of Companion Documents" field) for further information.

Number of Source Documents

Of the 46 citations in the original bibliography, 24 were retained in the final document. The new literature search conducted in August 2013 identified 15 articles that were added to the bibliography. The author added 14 citations from bibliographies, Web sites, or books that were not found in the new literature search.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Study Quality Category Definitions

Category 1 - The study is well-designed and accounts for common biases.

Category 2 - The study is moderately well-designed and accounts for most common biases.

Category 3 - There are important study design limitations.

Category 4 - The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:

a. The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description).
b. The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence.
c. The study is an expert opinion or consensus document.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author assesses the literature then drafts or revises the narrative summarizing the evidence found in the literature. American College of Radiology (ACR) staff drafts an evidence table based on the analysis of the selected literature. These tables rate the study quality for each article included in the narrative.

The expert panel reviews the narrative, evidence table and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the variant table(s). Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development documents (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Rating Appropriateness

The American College of Radiology (ACR) Appropriateness Criteria (AC) methodology is based on the RAND Appropriateness Method. The appropriateness ratings for each of the procedures or treatments included in the AC topics are determined using a modified Delphi method. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. The expert panel members review the evidence presented and assess the risks or harms of doing the procedure balanced with the benefits of performing the procedure. The direct or indirect costs of a procedure are not considered as a risk or harm when determining appropriateness. When the evidence for a specific topic and variant is uncertain or incomplete, expert opinion may supplement the available evidence or may be the sole source for assessing the appropriateness.

The appropriateness is represented on an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate" where the harms of doing the procedure outweigh the benefits; and 7, 8, or 9 are in the category "usually appropriate" where the benefits of doing a procedure outweigh the harms or risks. The middle category, designated "may be appropriate", is represented by 4, 5, or 6 on the scale. The middle category is when the risks and benefits are equivocal or unclear, the dispersion of the individual ratings from the group median rating is too large (i.e., disagreement), the evidence is contradictory or unclear, or there are special circumstances or subpopulations which could influence the risks or benefits that are embedded in the variant.

The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating. To determine the panel's recommendation, the rating category that contains the median group rating without disagreement is selected. This may be determined after either the first or second rating round. If there is disagreement after the second rating round, the recommendation is "May be appropriate."

This modified Delphi method enables each panelist to articulate his or her individual interpretations of the evidence or expert opinion without excessive influence from fellow panelists in a simple, standardized and economical process. For additional information on the ratings process see the Rating Round Information document on the ACR Web site.

Additional methodology documents, including a more detailed explanation of the complete topic development process and all ACR AC topics can be found on the ACR Web site (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

Summary of Evidence

Of the 53 references cited in the A*CR Appropriateness Criteria® Acute Respiratory Illness in Immunocompromised Patients* document, 2 are categorized as good quality therapeutic studies. Additionally, 51 references are categorized as diagnostic references including 1 well-designed study, 3 good quality studies, and 16 quality studies that may have design limitations. There are 31 references that may not be useful as primary evidence.

While there are references that report on studies with design limitations, 6 well-designed or good quality studies provide good evidence.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiographic imaging procedures for evaluation of acute respiratory illness in immunocompromised patients

Potential Harms

Relative Radiation Level

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging

procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Heitkamp DE, Albin MM, Chung JH, Crabtree TP, Iannettoni MD, Johnson GB, Jokerst C, McComb BL, Saleh AG, Shah RD, Steiner RM, Mohammed TL, Ravenel JG, Expert Panel on Thoracic Imaging. ACR Appropriateness CriteriaÂ® acute respiratory illness in immunocompromised patients [online publication]. Reston (VA): American College of Radiology (ACR); 2014. 8 p. [53 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1995 (revised 2014)

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Thoracic Imaging

Composition of Group That Authored the Guideline

Panel Members: Darel E. Heitkamp, MD (*Principal Author*); Matthias M. Albin, MD (*Research Author*); Jonathan H. Chung, MD (*Panel Vice-chair*); Traves P. Crabtree, MD; Mark D. Iannettoni, MD; Geoffrey B. Johnson, MD, PhD; Clinton Jokerst, MD; Barbara L. McComb, MD; Anthony G. Saleh, MD; Rakesh D. Shah, MD; Robert M. Steiner, MD; Tan-Lucien H. Mohammed, MD (*Specialty Chair*); James G. Ravenel, MD (*Panel Chair*)

Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Heitkamp DE, Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Dyer DS, Ginsburg ME, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® acute respiratory illness in immunocompromised patients. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 6 p. [45 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Electronic copies: Available from the American College of Radiology (ACR) Web site .

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2015 Feb. 3 p. Electronic copies: Available from the American College of Radiology (ACR) Web site.
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2015 Feb. 1 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2015 Feb. 3 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 2015 Feb. 2 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria® acute respiratory illness in immunocompromised patients. Evidence table. Reston (VA): American College of Radiology; 2014. 26 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria® acute respiratory illness in immunocompromised patients. Literature search. Reston (VA): American College of Radiology; 2014. 2 p. Electronic copies: Available from the ACR Web site.

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI on November 12, 2004. The information was verified by the guideline developer on December 21, 2004. This summary was updated by ECRI on March 22, 2006. This summary was updated by ECRI Institute on July 23, 2009. This summary was updated by ECRI Institute on February 29, 2012. This summary was updated by ECRI Institute on April 16, 2015.

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